

Carbon-Storing Material Technologies: The Current Landscape



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An aerial photograph of New York City at dusk, showing the dense urban landscape of Manhattan. Central Park is visible in the center, surrounded by skyscrapers. The Freedom Tower stands out prominently in the lower center. The Hudson River is on the left, and the East River is on the right. The sky is a mix of blue and orange from the setting sun.

Steel & Concrete Production:

> 11%

Global Greenhouse
Gas Emissions

Up-Front Embodied Carbon:

The carbon emissions (kgCO₂e) associated with the manufacture, transport, and installation of construction materials.

Photosynthesis

1kg Biomass = ~1.83 kg CO₂



Carbonate Mineralization

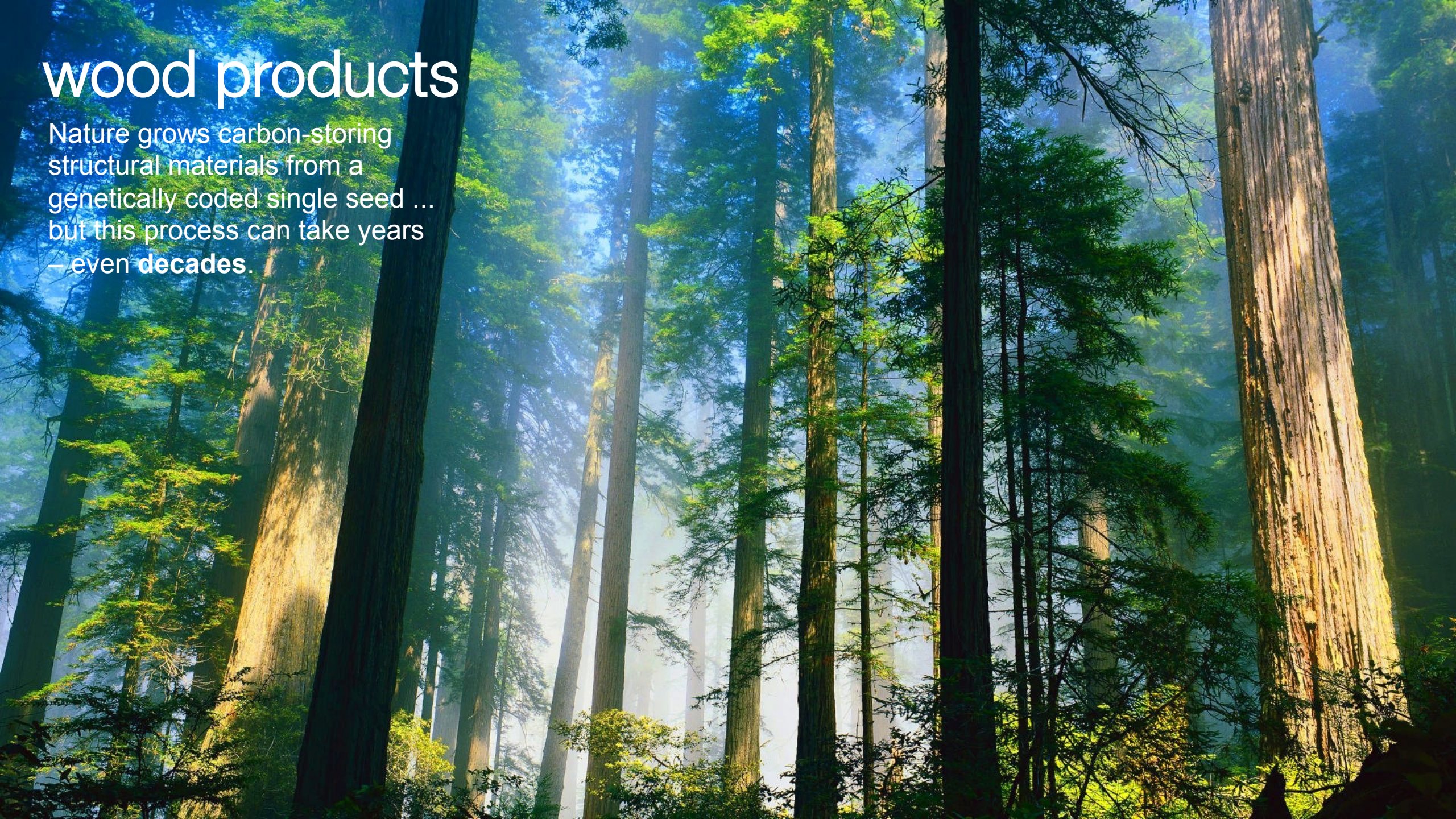
1 kg CaCO_3 = 0.44 kg CO_2

Carbon-Storing Building Materials:
The **Current** Landscape



wood products

Nature grows carbon-storing
structural materials from a
genetically coded single seed ...
but this process can take years
— even **decades**.



straw, hemp, and bamboo

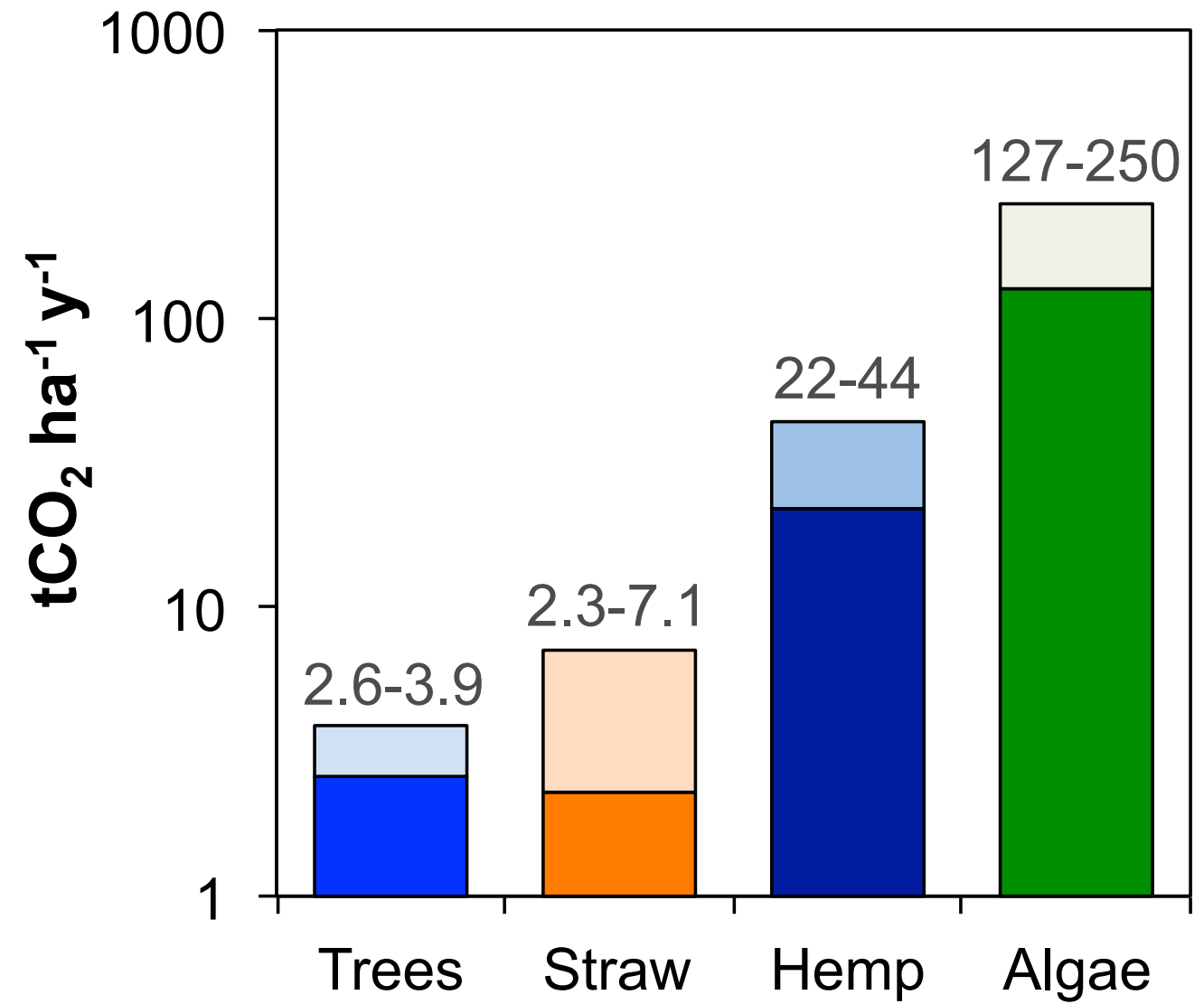
Rapidly grown biomass can be produced annually by the agriculture industry ... but growing materials **explicitly** for buildings can encumber significant land and water resources.



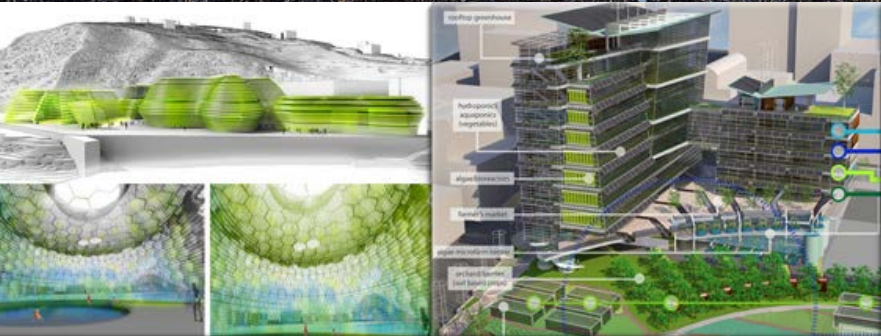


algae

Algae is already cultivated at scale for food, fuel, pharmaceuticals; now being exploited for building materials.



Srubar III, W.V. "Can We Grow Carbon-Storing Buildings?" in *Build Beyond Zero: New Ideas for Carbon-Smart Architecture*. B. King & C. Magwood, Eds. In press.



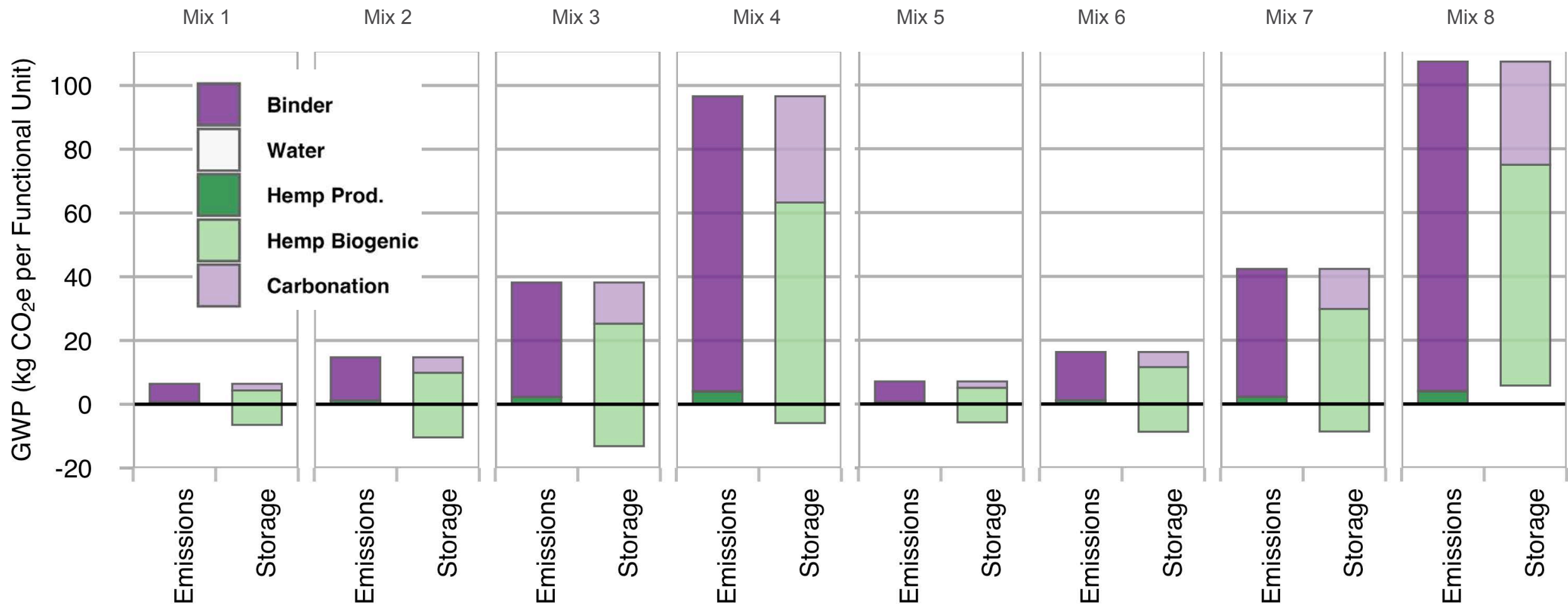


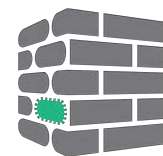
hempcrete

Hemp-lime composite that carbonates over time. 2014 Farm Bill legalized cultivation of hemp; hempcrete is produced regionally in many parts of the US

Hempcrete as a Carbon-Storing Building Material

LCA Stage A1-A3 Plus Carbonation (8 of 36 Hempcrete Mixes)





bioMASON®
building with nature

Prometheus™
Grown On Demand.

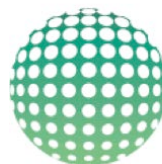
Chemical



Biological



**CARBON
CURE™**



**Solidia
Technologies**

+materials
x ÷





engineered living materials

Synthetic biology-enabled
growth of tailored building
material technologies.

Concluding Remarks & Important Considerations:

1. **Permanent and/or Long-Term Storage is Key.** Reducing carbon emissions of a product is **not enough**; we must draw down and store carbon. Buildings are vehicle by which we can achieve decades (centuries) of storage.
2. **Carbon Storage Mechanisms.** Photosynthesis and carbonate mineralization are two carbon-storing mechanisms that can be exploited to produce carbon-storing building materials. **The source of the carbon is important** (e.g., purified/industrial sources, point-source emissions, direct air capture). For biogenic carbon, the **temporal aspect of the anticipated storage** is most important. Example: Plywood. (Lock it Up!)
3. **LCA and Tools.** Because a technology is based on photosynthesis and/or carbonate mineralization, one of these mechanisms does not mean it is net-carbon storing. LCA must be used as a tool to quantify embodied carbon (+ biogenic carbon storage). (EPDs, too).
4. **The greenest building is one that's already built.**
5. **Markets and Drivers.** Construction is a commodity market. New materials have inherent technical and economic risks associated with them. How can we incentivize the use and specification of these materials?

Introducing:

Aureus Earth

The World's First Carbon Marketplace for Buildings

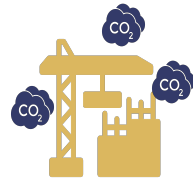
Active Pilot Projects:



Let's build something great together.

Contact us to discuss how we can help finance your low-carbon construction project.

For more information:
info@aureusearth.com
www.aureusearth.com



The entire world's building stock will double by 2060.



New buildings are a vehicle for CO₂e avoidance and storage.



Builders need incentives to use low-carbon and carbon-storing materials.



AE changes the financial equation, enabling builders to sell avoided and stored carbon as offsets.



Thank You



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